CLAIMS

1. An exhaust processor comprising

an acoustic resonator including a housing formed to include a static tuning volume and a tuning tube positioned to extend through an aperture formed in the housing into the static tuning volume, the tuning tube being formed to include an inlet opening adapted to receive engine combustion product therein and a first outlet opening arranged to lie in the static tuning volume and to place the static tuning volume in acoustic communication with acoustic waves associated with engine combustion product in the tuning tube, and

a resonator controller including a regulator mounted for movement in the static tuning volume formed in the housing alongside the tuning tube to vary the size of the first outlet opening formed in the tuning tube.

2. The exhaust processor of claim 1, wherein the housing includes first and second end walls and a side wall arranged to extend from the first end wall to the second end wall to define the static tuning volume therebetween and the first end wall is formed to include the aperture through which the tuning tube extends.

3. The exhaust processor of claim 2, wherein the second wall is formed to include an aperture, the tuning tube is arranged to extend through the aperture formed in the second wall, and the regulator is mounted to move back and forth on the tuning tube in one of a first direction toward the first end wall to minimize the size of the first outlet opening and a second direction toward the second end wall to maximize the size of the first outlet opening.

4. The exhaust processor of claim 2, wherein the resonator controller further includes a mover driver located outside of the static tuning volume and a regulator mover arranged to extend through an aperture formed in one of the first and second end walls and the regulator mover is coupled to the mover driver and to the regulator to transmit motion generated by the mover driver to the regulator to cause the regulator to move alongside the tuning tube to vary the size of the first outlet opening formed in the tuning tube.

5. The exhaust processor of claim 1, wherein the housing includes first and second end walls and a side wall arranged to extend from the first end wall to the second end wall and the resonator controller further includes a mover driver

located outside of the housing and a regulator mover arranged to extend through an aperture formed in the first end wall and the regulator mover is coupled to the mover driver and to the regulator to transmit motion generated by the mover driver to the regulator to cause the regulator to move alongside the tuning tube to vary the size of the first outlet opening formed in the tuning tube.

6. The exhaust processor of claim 5, wherein the housing further includes a baffle coupled to the side wall and positioned to lie inside the housing between the first and second end walls and the regulator mover is arranged to extend through an aperture formed in the first baffle.

7. The exhaust processor of claim 5, wherein the housing further includes a baffle coupled to the side wall and positioned to lie inside the housing between the first and second end walls, the baffle is formed to include first and second apertures, the tuning tube is arranged to extend through the first aperture, the regulator is arranged to extend through the first aperture during movement of the regulator alongside the tuning tube, and the regulator mover is arranged to extend through the second aperture.

8. The exhaust processor of claim 5, wherein the regulator operator further includes a guide rod mounted in a fixed position in the housing and a slidable collar coupled to the regulator mover and mounted for sliding movement on the guide rod to cause the regulator to move relative to the tuning tube along an axis parallel to a longitudinal axis established by the guide rod.

9. The exhaust processor of claim 8, wherein a first end of the guide rod is coupled to the first end wall and a second end of the guide rod is coupled to the second end wall.

10. The exhaust processor of claim 8, wherein the housing further includes first and second baffles coupled to the side wall and positioned to lie inside the housing and between the first and second end walls, a first end of the guide rod is coupled to the first baffle, a second end of the guide rod is coupled to the second baffle, and the regulator mover is arranged to extend through an aperture formed in the first baffle.

11. The exhaust processor of claim 1, wherein a field of perforations is formed in the tuning tube to define the first outlet opening and the

regulator is a sleeve formed to include a longitudinal passageway extending therethrough and receiving the tuning tube therein.

12. The exhaust processor of claim 11, wherein the housing further includes a baffle located in the static tuning volume and formed to include first and second apertures, the tuning tube is arranged to extend through the first aperture, the sleeve is arranged to extend through the first aperture during movement of the sleeve alongside the tuning tube, and the resonator controller further includes a resonator operator arranged to extend into the static tuning volume through an aperture formed in the housing to couple to the sleeve and to move relative to the housing to control movement of the sleeve relative to the tuning tube.

13. The exhaust processor of claim 1, wherein the housing includes first and second end walls, a side wall arranged to extend from the first end wall to the second end wall to define an interior region therebetween, and a baffle coupled to the side wall and arranged to partition the interior region to define the static tuning volume between the first end wall and the baffle and a low-frequency static tuning volume between the baffle and the second end wall, the baffle is formed to include a central aperture, the tuning tube is arranged to extend through the central aperture and terminate at a second outlet opening positioned to lie in the low-frequency static tuning volume, and further comprising a low-frequency tuning tube formed to include an inlet opening coupled to the second outlet opening of the tuning tube to cause engine combustion product discharged from the tuning tube to pass into the low-frequency tuning tube, a first outlet opening arranged to lie in the low-frequency static tuning volume to place the low-frequency static tuning volume in acoustic communication with acoustic waves associated with engine combustion product in the low-frequency tuning tube, and the low-frequency tuning tube is arranged to extend through an aperture formed in the second end wall to conduct engine combustion product to a destination outside of the housing.

14. The exhaust processor of claim 1, wherein the tuning tube is formed to terminate at a second outlet opening positioned to lie in the static tuning volume and further comprising a low-frequency tuning tube formed to include an inlet opening coupled to the second outlet opening of the tuning tube to cause engine combustion product discharged from the tuning tube to pass into the low-frequency tuning tube, a first outlet opening arranged to lie in the static tuning volume to place

the static tuning volume in acoustic communication with acoustic waves associated with engine combustion product in the low-frequency tuning tube.

15. The exhaust processor of claim 1, wherein the housing includes first and second end walls, a side wall arranged to extend from the first end wall to the second end wall to define an interior region therebetween, and a baffle arranged to partition the interior region to define the static tuning volume between the baffle and one of the first and second end walls and another static tuning volume between the baffle and the other of the first and second end walls, the baffle is mounted for movement relative to the side wall to cause said static tuning volumes to vary in size as the baffle moves back and forth in the interior region formed in the housing, the baffle is formed to include a central aperture receiving the tuning tube and regulator therein, the regulator is coupled to the baffle for movement therewith relative to the tuning tube and the side wall, and the resonator controller further includes a regulator operator arranged to extend into the static tuning volume through an aperture formed in the housing to couple to the regulator and to move relative to the housing to control movement of the baffle and regulator relative to the tuning tube extending through the central aperture formed in the baffle.

16. The exhaust processor of claim 15, wherein a portion of the first outlet opening formed in the tuning tube is arranged to lie in each of the static tuning volumes.

17. The exhaust processor of claim 1, further comprising a second tube positioned to extend through a second aperture formed in the housing into the static tuning volume, the second tube being formed to include an inlet opening arranged to lie in the static tuning volume to allow engine combustion product discharge from the tuning tube into the static tuning volume through the first outlet opening formed in the tuning tube to pass into a passageway formed in the second tube, and wherein the resonator controller further includes a second regulator mounted for movement in the static tuning volume formed in the housing alongside the second tube to vary the size of the inlet opening formed in the second tube and a regulator operator arranged to extend into the static tuning volume and coupled to each of the regulator and the second regulator to control movement of said regulators as a unit relative to the tuning tube and the second tube.

18. An exhaust processor comprising

a housing defining an interior region and having an inlet and an outlet,

a flow conduit located in the interior region of the housing to conduct engine combustion product from the inlet to the outlet,

a static tuning volume located in the interior region of the housing and separate from the flow conduit,

a tuning tube positioned to lie in the interior region of the housing to extend into the static tuning volume, the tuning tube being formed to include an inlet opening positioned to receive therein engine combustion product extant in the flow conduit and an outlet opening arranged to lie in the static tuning volume and to place the static tuning volume in acoustic communication with acoustic waves associated with engine combustion product in the tuning tube, and

a resonator controller including a regulator mounted for movement in the static tuning volume alongside the tuning tube to vary the size of the outlet opening formed in the tuning tube.

19. The exhaust processor of claim 18, wherein the housing includes first and second end walls, and a side wall arranged to extend from the first end wall to the second end wall to define the interior region therebetween and the flow conduit includes an inlet section bounded by the first end wall, the baffle, and a portion of the side wall located between the first end wall and the baffle and an outlet section defined by a tube extending through the static tuning volume and having an inlet extending through an aperture formed in the baffle to receive engine combustion product from the inlet section and an outlet extending through an aperture formed in the second end wall.

20. An exhaust processor comprising

an engine configured to have at least two modes of operation and produce engine combustion product characterized by an acoustic signature unique to each mode of operation,

an acoustic resonator including a static tuning volume, a tuning tube formed to include a passageway having an inlet opening arranged to receive engine combustion product produced by the engine, and a first outlet opening formed in the tuning tube to place the static tuning volume in acoustic communication with acoustic waves associated with engine combustion product in the tuning tube, and

a resonator controller including a regulator mounted for movement alongside the tuning tube to vary the size of the first outlet opening formed in the tuning tube, an engine mode detector coupled to the engine and configured to detect the mode of operation of the engine, and a regulator operator linked to the engine mode detector and the regulator to provide means for moving the regulator alongside the tuning tube to vary the size of the first outlet opening in accordance with a first predetermined criteria based on a selected engine parameter communicated to the regulator operator when the engine is operated in a first mode of operation and with a second predetermined criteria based on the selected engine parameter communicated to the regulator operator when the engine is operated in a second mode of operation.